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PELVIC FLOOR COMPLICATIONS AFTER VAGINAL BIRTH

SHORT- AND LONG-TERM CONSEQUENCES FOR PRIMIPAROUS WOMEN IN SWEDEN

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Pelvic floor complications after vaginal birth
Short- and long-term consequences for primiparous
women in Sweden
THESIS FOR DOCTORAL DEGREE (Ph.D.)

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To all women, especially to those who participated in this research project.

ABSTRACT

Women giving birth to their first baby often sustain some form of perineal injury. These injuries can cause short- and long-term pelvic floor dysfunction symptoms and may affect their health. This thesis focuses on a sample of 597 primiparous women who participated in the MIMA (Midwives' Management during the Second Stage of Labour) project. MIMA demonstrated a reduction of second-degree tears related to supporting slow birth of the baby's head, in combination with spontaneous pushing in a flexible sacrum position.

AIM: The overall aim of this thesis was to investigate and evaluate perineal injuries, postpartum pelvic floor complications and consequences affecting women after the birth of their first child, up to 1.5 year postpartum. Specific research questions were applied to investigate the prevalence of and women's experiences of haemorrhoid symptoms, perineal pain, postpartum care, urinary incontinence (UI), anal incontinence (AI) and bowel-emptying difficulties.

METHODS: **Study I**, a mixed method study with an experimental, explanatory, sequential design, investigated the prevalence and women's experiences of haemorrhoid symptoms (n=496). An initial quantitative phase was followed by qualitative content analysis. **Studies II-IV** were cohort studies. In **Study II**, in which 461 women participated, we investigated the prevalence of perineal pain and postpartum care uptake. **Study III** and **Study IV** included 410 women and investigated the prevalence of UI, AI and bowel-emptying difficulties related to obstetric variables. We applied bivariate analysis and logistic regression, adjusting for risk factors (**Study I**). Descriptive statistics were used to present data, and the Chi-Square test was used to compare perineal pain and severity of perineal injury during the first year postpartum (**Study II**). Data in **Study III** and **IV** were analysed with the Chi-Square test, and **Study III** also included the Independent t-test.

RESULTS: **Study I:** Women managed with the MIMA model of care reported fewer haemorrhoid symptoms three weeks postpartum, compared to women in the standard care group. The MIMA model remained protective after adjusting for potential risk factors (adj. OR 0.6; 95% CI 0.4-0.9). Half of the women had remaining symptoms 1.5 year postpartum and these women experienced that they had been neglected in the healthcare system. **Study II:** The severity of perineal injury was related to the occurrence of perineal pain during the first year postpartum. A majority (75.0%) of the women with a severe injury, more than half (61.8%) with type-II moderate injury and 44.0% with type-I moderate injury reported perineal pain three months postpartum ($p < 0.002$). At six months postpartum, the

corresponding respective figures were 60.0%, nearly 40.0% and one-fifth ($p < 0.001$). One in four women who attended the postpartum visit did not undergo vaginal examination and was not given any advice about pelvic floor exercises. **Study III:** About 40% of the women had UI, of which stress urinary incontinence was the most common type, 9–12 months after birth. Known risk factors, i.e. long duration of the second stage and the baby's head circumference and birth weight, were not associated with the prevalence of UI. **Study IV:** Women sustaining minor or second-degree tears complained of bowel-emptying difficulties or AI 9–12 months postpartum at a rate comparable to those who had tears involving the anal sphincter complex. **Studies III and IV:** The women reported that AI and UI had an impact on their daily activities, as well as significantly impairing psychological wellbeing.

CONCLUSIONS: Slow birth of the baby's head in combination with spontaneous pushing may reduce haemorrhoid symptoms three weeks after delivery in primiparous women. Nearly half of the women had persisting haemorrhoid symptoms 1.5 year postpartum, and they experienced that they had been neglected in the healthcare system. Perineal pain was associated with the severity of perineal injury. Women with moderate injuries had persisting perineal pain six and twelve months after delivery. One in four women suffered from UI 9–12 months postpartum. Furthermore, women experienced that UI and AI impacted their daily activities and significantly affected their psychological wellbeing. Women sustaining minor or second-degree tears had bowel-emptying difficulties and AI 9–12 months postpartum at a rate comparable to those who had tears involving the anal sphincter complex.

Keywords: Primiparous, haemorrhoids, perineal trauma, pelvic floor dysfunction, pain, urinary incontinence, anal incontinence, midwifery, postpartum

LIST OF SCIENTIFIC PAPERS

- I. Susanne Åhlund, Ingela Rådestad, Sofia Zwedberg, Malin Edqvist, Helena Lindgren
Haemorrhoids – A neglected problem faced by women after birth. *Sexual & Reproductive Healthcare*. 2018,18,30-36.
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- IV. Emilia Rotstein, Susanne Åhlund, Helena Lindgren, Angelica Hirschberg, Ingela Rådestad, Gunilla Tegerstedt. Posterior compartment symptoms in primiparous women one year after non-instrumental vaginal deliveries - a Swedish cohort study. *Manuscript*.

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LIST OF ABBREVIATIONS

AI	Anal incontinence
CEQ	Childbirth Experience Questionnaire
IASP	International Association for the Study of Pain
ICM	International Confederation of Midwives
ICS	International Continence Society
LAM	Levator ani muscles
MIMA	Midwives' Management during the Second Stage of Labour
MUI	Mixed urinary incontinence
NRS	Numerical Rating Scale
OR	Odds Ratio
PFD	Pelvic floor Dysfunction
PFDI-20	Pelvic Floor Distress Inventory
PFIQ-7	Pelvic Floor Impact Questionnaire
PISQ-12	Pelvic Organ Prolapse/Urinary Incontinence Sexual Questionnaire
PLR	Perineal Laceration Register
RCOG	The Royal College of Obstetricians and Gynaecologists
SUI	Stress urinary incontinence
UI	Urinary incontinence
UUI	Urgency urinary incontinence
VAS	Visual Analog Scale
VRS	Verbal Rating Scale

1 INTRODUCTION

The Lancet series on midwifery provides evidence for and identifies the value of promoting and supporting the normal process around childbirth, thus improving maternal health. The target is a continuum of care for expectant and new parents, with comprehensive support involving a minimum number of care providers from early pregnancy to one year after birth (1). The declining duration of the hospital stay after delivery means that midwives do not always have time to assess a woman's need for care and support.

The first year postpartum is a time of significant challenges for most women. It is well known that pregnancy and birth may lead to a variety of different short- and long-term pelvic floor dysfunctions (PFD), which can affect women's quality of life. Previous research, mostly with a short-term perspective, has mainly focused on consequences of severe perineal trauma, not on the majority of women who have undergone uncomplicated vaginal delivery with minor or moderate perineal injuries. However, physiological changes during pregnancy and less severe injuries may also cause PFD. There is a lack of knowledge on short- and long-term symptoms, such as perineal pain, haemorrhoid symptoms, urinary incontinence (UI) and anal incontinence (AI), during the first year postpartum, in relation to the second stage of labour.

One way to address PFD and to implement evidence-based care for women is to increase knowledge of the respective prevalences, as well as of potential associations with management in care and women's experiences. The objective of this thesis was to contribute to the body of knowledge on risk factors for childbirth-related symptomatic haemorrhoids, UI, AI, bowel-emptying difficulties and perineal pain at various time-points during the first 18 months postpartum. Furthermore, the aim was to study the potential impact on women's quality of life.

2 BACKGROUND

2.1 ANATOMY OF THE PELVIC FLOOR

The pelvic floor constitutes the bottom of the abdominal cavity and consists of two levels containing muscles, connective tissues, nerves and sphincters muscles. The deeper first layer of the pelvic floor is the pelvic diaphragm, that consists of the levator ani muscles (LAM), the coccygeus muscle, the endopelvine fascia, nerves and connective tissue. The LAM muscle complex consists of the iliococcygeus, the pubococcygeus and the puborectalis muscles. The LAM muscle complex supports the organs of the pelvis, aids in maintaining continence by creating the anorectal angle and plays an important role in sexual function. It attaches anteriorly to the posterior surface of the inferior pubic rami, posteriolaterally to the medial surface of the ischium and posteriorly to the coccyx. The LAM collaborate during urination and defecation, supporting the bladder neck and the anorectum and are innervated by branches of the pudendal, inferior rectal, perineal and sacral nerves (2, 3).

The superficial second layer of the pelvic floor is the urogenital diaphragm. It consists of the deep transverse perineal muscle, bulbocavernosus and puboanalis muscles, transverse perineal and external anal sphincter muscles (4). The bulbocavernosus muscle surrounds the vaginal opening, and contributes to clitoral erection and orgasm (4, 5). The transverse perineal muscle is an important structure that supports the external anal sphincter and the anal canal.

The endopelvine fascia is a network of connective tissue fibres that attach to the pelvic walls and support the bladder, vagina and rectum (5). Together, with the endopelvine fascia, nerves and connective tissue and the LAM and coccygeus muscles form the pelvic diaphragm.

The puborectalis muscle loops posteriorly around the rectum and attaches anteriorly to the pubic rami, aiming to maintain the anorectal angle that is required to obtain anal incontinence. It attaches to the upper part of the anal sphincter complex, which consists of the internal and external sphincter muscles. The internal sphincter consists of a continuation of the circular fibres of the rectum, while the external sphincter consists of striated muscles and is controlled voluntarily. It is fused to the transverse perineal muscles and to the perineal body. Together with the LAM complex, the internal and external anal sphincters control continence. Any change in this structure or function caused by perineal trauma may predispose the woman to constipation or faecal incontinence (2).

The perineal body is a pyramidal fibromuscular tissue in the midline of the perineum, between the external anal sfincter and the posterior vaginal wall. In where the transverse perineal muscles, bulbocavernosus, the external anal sfincter, anterior fibres of the LAM, innervate and support the pubourethral ligaments (6, 7). The perineal body has an important role in the support of the pelvic floor (7).

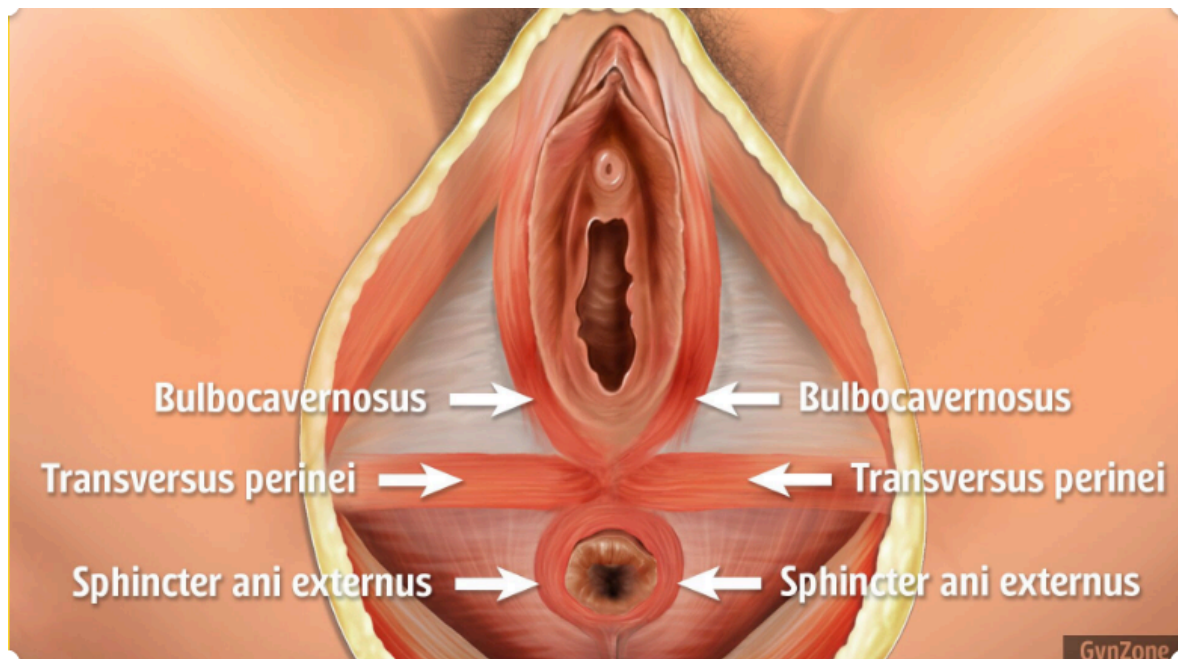


Figure 1 The superficial muscles that form the urogenital diaphragm. Reprinted with permission from Sara Kindberg-Fevre. www.gynezone.dk

2.2 PERINEAL INJURIES

According to global statistics, as many as 86%-94 % of first-time mothers who give birth vaginally sustain some kind of perineal injury (8-11), that may contribute to short- and long-term morbidity. The pelvic floor, its muscles and nerves and the endopelvine fascia may be damaged during birth due to stretching, compression or ischemia (12). Stretching may result in spontaneous laceration, compression and ischemia, as well as in occult damage such as neurogenic injury and LAM trauma (13, 14).

Injury only including the skin and mucosa in labia, perineum and vagina is called a first-degree tear, while a second-degree tear involves the underlying bulbocavernosus, transverse perineal, puborectalis muscles and fascia. According to 2017 statistics from the Swedish National Board of Health and Welfare, 5.2 % of primiparous women in Sweden sustained a sphincter injury, i.e. a third- or fourth degree tear, during vaginal birth (15).

Primiparous women are at the highest risk of at least a second-degree tear (11). A first-degree tear is not always sutured and usually heals without any persisting symptoms. Second-degree tears can, in the worst case, cause problems similar to those caused by anal sphincter tears (16). Sometimes an anal sphincter injury is not detected immediately after birth and is wrongly classified as a second-degree tear (17). The frequency of these so-called occult sphincter tears has been reported to vary between 20% and 41% (18).

Injuries to the labia, urethra or clitoris are called anterior perineal trauma (19). Injuries to the posterior vaginal wall, anal sphincter or perineal muscles are called posterior perineal trauma (14). Posterior perineal trauma is also caused by episiotomy (7). The pubococcygeus muscle

may be involved in deep perineal injuries or damaged by episiotomy (7). A second-degree tear involves the perineal body, and the muscles that are inserted in the perineal body between the posterior vaginal wall and the external anal sphincter (6, 7).

Perineal trauma may also include LAM injury, which has been reported in 13% -36% of primiparous women after vaginal birth (20). LAM can be damaged as part of the damage in the perineal body or by a so-called avulsion injury as it completely or partially detaches from the pubic bone (21).

The rectovaginal fascia, a thin connective septum separating the rectum and vagina, is often involved in a perineal injury. If not sutured, this may cause a decreased support of the posterior vaginal wall (22): a fascia tear may lead to bulging of the posterior vaginal wall into the vagina, creating a need to digitally reduce the bulge or put pressure on the perineum to either initiate or complete defecation (22). A national quality register, the Perineal Laceration Register (PLR), was started in Sweden in 2014, in order to systematically identify women in need of treatment, as well as to compare hospitals' patient-related outcomes. Second-degree tears were not registered initially, so we do not know how common they were in the past. However, since 2015 it is possible to report second-degree tears in the PLR (23).

2.3 CLASSIFICATION OF PERINEAL INJURIES

Perineal injuries can thus vary between minor laceration and extensive vaginal and perineal trauma including the anal sphincter complex. The Royal College of Obstetricians and Gynaecologists (RCOG) classification (24) only distinguishes tears including the sphincter complex, not minor or extensive perineal or vaginal injuries.

Table 1. Classification of perineal trauma, RCOG (24).

First-degree tear	Laceration is limited to the fourchette and superficial perineal skin or vaginal mucosa.
Second-degree tear	Laceration extends beyond the fourchette, perineal skin and vaginal mucosa to perineal muscles and fascia, but not the anal sphincter.
Third-degree tear	Laceration to the perineal skin, vaginal mucosa, anal sphincter are torn; third degree tears may be further subdivided into three subcategories <ul style="list-style-type: none"> ➤ 3a: partial tear of the external anal sphincter involving less than 50% thickness ➤ 3b: greater than 50% tear of the external anal sphincter ➤ 3c: internal sphincter is torn
Fourth-degree tear	The fourchette, perineal skin, vaginal mucosa, anal sphincter, and rectal mucosa are torn.

It is necessary to assess and describe perineal and vaginal injuries in more detail. A classification system for minor trauma has been developed in Sweden by the Swedish

Association of Midwives and the Swedish Society of Obstetrics & Gynecology (Figure 2) and is published on a web site (25) . It is used to classify vaginal and perineal injury, aiming at describing second-degree tears in more detail.

Table 2. A new Swedish classification system (25)

First-degree tear	Injury to skin and/or mucosa of the labia, perineum and/or vaginal wall
Second-degree tear	Grade 2a: part of the perineal body (0.5-2cm) and < 4 cm length in the vagina
	Grade 2b: entire perineal body but not involving the anal sphincter <u>or</u> > 4 cm length in the vagina
	Grade 2c: entire perineal body but not involving the anal sphincter <u>and</u> >4 cm length in the vagina

2.4 RISK FACTORS FOR PERINEAL INJURY

There are several risk factors for perineal injury during birth, some of which can be at least partially reduced. One risk factor is nulliparity; nulliparous women are more likely than multiparous women to contract second-degree tears and severe injuries affecting the anal sphincter complex (8, 26). Other risk factors include delivery by forceps or vacuum extraction, high birth weight, episiotomy, lengthy second-stage of labour, fundal pressure and giving birth in the lithotomy position (17, 27-30). One protective measure is the use of warm compresses during the second stage of labour, which has been shown to reduce perineal trauma (31). Another important protective factor is slow and controlled delivery of the baby's head at the end of a contraction or between contractions (32). Good communication and cooperation between the birthing woman and the midwife is also perceived by midwives to be an important technique to prevent perineal trauma (33, 34). Several risk factors have been associated with LAM injury, such as forceps, head circumference exceeding 35.5 cm and long duration of the second stage of labour (35, 36).

Some studies have found that avoidance of the lithotomy position, choosing the kneeling or lateral position instead, can reduce perineal trauma (37, 38). A Swedish study found that the supine and semi-recumbent positions are the most common birth positions among nulliparous women in Sweden (39). This is the case in other industrialized countries as well (40). In another Swedish study, 77% of first-time mothers gave birth in the semi-recumbent or lithotomy position (37). However, upright birth positions have been reported to have both physiological and psychological advantages. In addition to a shortened second stage of labour and decreased pain, the upright birth position has been found to be associated with increased satisfaction with delivery (41). Birthing positions that take the weight off the sacrum and allow

the pelvis to expand can be categorized as flexible sacrum positions (42). Kneeling, standing, resting on all fours, the lateral position, squatting and giving birth on a birthing stool are all positions providing for flexibility in the sacroiliac joints (40, 42).

2.5 PELVIC FLOOR DYSFUNCTION

2.5.1 Urinary incontinence

According to the International Urogynecological Association (IUGA)/International Continence Society (ICS), UI is defined as “any complaint of involuntary leakage of urine”(43). It is the most common PFD symptom, with prevalence rates varying between 32% and 64% (44). In the age group 35-64 years, 16.4 % reported problems with UI, and the prevalence increased significantly with age (45). There are three main types of UI: stress urinary incontinence (SUI), urgency urinary incontinence (UUI) and mixed urinary incontinence (MUI). However, most published research on UI evaluates it as an entity, rather than investigating these categories separately.

SUI, defined as “the complaint of involuntary leakage on effort or exertion, or on sneezing or coughing”, is the most common type of UI (43). SUI is related to insufficient urethral sphincter muscle strength and inadequate supportive structures in the pelvic floor, such as pelvic floor muscles, connective tissues and fasciae.

UI is strongly associated with childbirth and causes major health problems among women (46, 47). Indeed, pregnancy and childbirth are the main risk factors for developing UI; primiparous women had three times higher prevalence than their age-matched nulliparous controls in a study by Hansen et al. (48). Mørkved and Bø (49) found that 42 % of all women reported UI problems during pregnancy and the rate was still high, 38%, two months after birth (49). The impact of vaginal birth on UI is most evident in the early postpartum stage. Severe UI and UUI symptoms are more common after vaginal birth than after caesarean section, but the differences diminished between the groups with time (47). There is little known as yet about the relationship between birth, pelvic floor changes and SUI; the issue of the protective effect of caesarean birth is still controversial.

2.5.2 Anal incontinence

Maintaining anal continence involves a complex mechanism of anorectal function, colon transit and stool volume and texture and requires proper integrated neuromuscular function, sensory capacity and the action and coordination of muscle groups (50). However, the pathophysiology is not fully understood (51).

The reported prevalence of AI during pregnancy and postpartum varies, depending on the definition of AI, how it is assessed and the time-point at which questions regarding AI symptoms are asked (52). The definition and terminology of AI in this thesis follows that in the IUGA/ ICS Joint Report on Terminology for Female Pelvic Floor Dysfunction (53). AI includes involuntary voiding of solid or liquid faeces, passive faecal incontinence (defined as soiling without warning and difficulty wiping area clean), voiding of faeces during coitus, flatal incontinence and faecal urgency. Flatal incontinence is defined as involuntary loss of

flatus and faecal urgency is a sudden need to rush and empty one's bowels, i.e. difficulty in deferring the urge to defecate (53). Women suffering from AI report increased rates of defecation dysfunction, such as incomplete bowel-emptying (54), a disorder in which the pelvic floor muscles and rectum do not work together normally (54).

AI occurs during pregnancy in nulliparous women, with a prevalence of between 12% and 35% for flatal incontinence and 2.0% to 9.5% for loss of solid faeces (55, 56). Seventeen percent of primiparous women report AI at some point during the first 12 months postpartum (57). One year postpartum, the reported prevalence of flatal incontinence in primiparous women is 30%, while the reported prevalence of other AI in primiparous women is 3.0% (58).

A systematic review suggested that the aetiological factor most strongly associated with AI postpartum is sphincter injury (59), but it also occurs after less severe trauma (60).

2.5.3 Haemorrhoids

Haemorrhoids are cushions of highly vascular tissue found in the submucosal space, and they are a normal part of the lower part of the rectum, i.e. the anal canal. This area is a complex of arteries, capillaries and veins and contains three main cushions found in the left lateral, right anterior and right posterior positions. Haemorrhoids are located in an environment consisting of elastic tissue, connective tissue, smooth muscles and blood vessels with valves that open and close to swell and shrink them (61). Each cushion has a surrounding arteriovenous connection to the terminal branches of the middle rectal arteries and the middle inferior and superior rectal veins. Haemorrhoids are covered by anoderm, a very sensitive skin layer that forms the outer covering of the anus (62). They have an important function within the anal canal in contributing to maintenance of continence and prevention of the release of liquids, stool and gases during coughing, straining or sneezing, since they close the anus when they swell due to blood inflow (63, 64). Haemorrhoids play an important role in the sensory function central to differentiation between liquid, solid stool and gas and the subsequent action of defecation (64).

Haemorrhoids do not constitute a disease unless they become symptomatic (65). Symptoms from haemorrhoids range from itching, mucoid discharge, mucosal or faecal soiling, light or heavy bleeding to rectal discomfort. If they become thrombosed, haemorrhoids can also cause severe pain (64). Quality of life can be affected in different ways, from mild discomfort to difficulty dealing with the activities of everyday life, such as sitting, walking, defecation, sleeping and caring for the baby (66).

The reported prevalence of symptomatic haemorrhoids is 8%-24% during the first three months postpartum, 24% three-six months postpartum and 16% after six months (67). A prolonged second stage of labour is a risk factor for haemorrhoids becoming symptomatic, as are high birth weight, post-term delivery, assisted vaginal birth and prolonged straining during the second stage of labour (68, 69). Factors that contribute to the development of pathological changes in the haemorrhoidal cushions are constipation, exercise, gravity, pregnancy, irregular bowel habits and genetics (70).

2.5.4 Perineal pain

Pain is defined as “an unpleasant sensory and/or emotional experience associated with actual or potential tissue damage or described in terms of such damage” by the International Association for the Study Of Pain, (IASP) (71). The definition refers to that pain is an experience, and is therefore always subjective. It is also unpleasant and therefore also an emotional experience (72). Perineal pain is common during the first six months after childbirth, regardless of perineal trauma (73). It has been reported that 88% of women suffer from perineal pain during the first days after birth and nearly 73% of primiparous women reported perineal pain within the first two months postpartum (74-76). Operative vaginal birth, episiotomy and anal sphincter rupture are reported risk factors for perineal pain postpartum (70). Women with intact perineum report pain less frequently (75, 77).

The intensity and discomfort related to perineal pain is often unexpected and can have a negative impact on women's daily activities, for instance when passing urine or faeces (78). Persisting perineal pain during the first six months postpartum is a risk factor for developing dyspareunia and chronic perineal pain (79, 80). Since pain related to perineal injury seems to be one of the most common postpartum sexual health problems, it is essential that caregivers pay attention to women's silent suffering (81).

2.6 EFFECTS ON WOMEN'S DAILY LIFE

Perineal injuries can cause long-term consequences for women's quality of life (82). Women who have contracted severe perineal injuries report that their wellbeing and sexuality are affected both physically and psychologically (83). As mentioned above, in addition to pain, obstetric damage to the pelvic floor and supportive structures can lead to UI, AI, bowel-emptying problems, prolapse of the vaginal walls and sexual dysfunction. These problems are often underreported (84, 85). Some women who have sustained perineal trauma do not experience any symptoms at all while others may have long-term residual problems (86). Earlier research has focused on severe perineal trauma, while minor injuries are less studied. Extensive (second-degree) rupture of the vagina can, in the worst case, cause problems similar to those caused by anal sphincter rupture and markedly influence quality of life (83). Postpartum physical health problems are common and all too often the result of perineal injuries. Data from the United States show that more than two-thirds (69%) of the women who had reported had experienced at least one physical health problem 9-12 months postpartum (87). Long-term consequences of perineal injuries are associated both with suffering and high costs for society.

2.7 MATERNITY CARE IN SWEDEN

Maternity care in Sweden, the context of this thesis, is based on a publicly funded system with the midwife as the primary caregiver. Antenatal care is organised within the primary healthcare system. During a normal pregnancy, 6–9 visits to the midwife are recommended (88). Pregnant women usually see the same midwife during these antenatal visits. Intrapartum care is usually hospital-based and almost all women give birth in a labour ward under the qualified care and

support of a midwife and, in case of complications, an obstetrician. Immediately after birth, the woman is examined by the delivery midwife in order to detect any perineal trauma.

2.7.1 Postnatal care

As in other European countries, the postpartum hospital stay has successively become shorter in Sweden, and Sweden is at the same time, the country with the shortest duration of care (1.8 days) after vaginal birth in the EU (89). The delivery hospitals are responsible for the health of the woman and her baby during the first seven days after birth. Swedish national guidelines recommend a postpartum check-up with the antenatal care midwife 6-12 weeks after delivery (88). The postpartum visit includes discussion about the birth experience, current health status and sexual health, as well as contraception counselling. A gynaecological examination is offered and the woman is given information about pelvic floor exercises for the prevention of UI (88). The National Board of Health and Welfare's survey 2017 (90), reported that most hospitals in Sweden undertake a follow-up examination by an obstetrician, and in some cases a physiotherapist, for women with third- or fourth-degree tears (90). Women with first- or second-degree tears are followed up at the above-mentioned postpartum visit (88). Sixty percent of healthcare authorities in Sweden have multidisciplinary reception centres for pelvic floor injuries, where several specialists can treat UI, AI and other complications resulting from pelvic floor damage after birth (91). These centres also treat PFD with non-obstetric causes (90).

2.7.2 Patient feedback – room for improvement

Healthcare during and after pregnancy and birth in Sweden has been described as fragmented and not organised to provide sufficient continuity (90). In a study of new mothers' satisfaction with antenatal care, postpartum care, child health care during the first two weeks and breastfeeding, as well as their physical and psychological well-being, 18% percent rated the support provided as insufficient or completely insufficient (92). A study by Martin et al. showed a disconnect between what providers viewed as “normal” postpartum recovery and what new mothers classified as major problems that created difficulty in their postpartum life. The women had not expected many of the symptoms they experienced after birth and were disappointed with the lack of support from providers during this critical time in their recovery (93). Furthermore, there is a link between women's physical health and depressive symptoms during the first year postpartum. If these early symptoms become chronic, it might undermine their general mental health (94, 95).

2.8 SUMMARY

Women's health and symptoms related to perineal injuries during the first year after birth is an under-investigated area. Knowledge and understanding about the symptoms women suffer postpartum and the potential effects on their health and quality of life is limited. First- and second-degree tears are considered to be an uncomplicated result after birth, although they constitute potential risk factors for PFD. Earlier research has mainly focused on the consequences of severe perineal trauma, predominantly with a short-term perspective, rather

than on the majority of women undergoing low-risk vaginal birth with minor or moderate perineal injuries. Since women giving birth to their first child are at high risk of contracting some kind of perineal injury that may lead to a variety of different short- and long-term PFD, we wanted to identify risk factors and to investigate symptoms emerging during the first 1.5 year postpartum.

3 AIM

The overall aim of this thesis was to investigate and evaluate perineal injuries, postpartum pelvic floor complications and how the related consequences affected women after the birth of their first child, up to 1.5 year postpartum.

Specific aims of the studies

Study I To investigate the prevalence and severity of haemorrhoid symptoms after birth in primiparous women in relation to management procedure followed during the second stage of labour, and to describe the women's experiences of having haemorrhoids.

Study II To describe the prevalence of perineal pain related to perineal injury within the first year after birth among primiparous women in Sweden, and to what extent they attended the postpartum check-up. Moreover to determine whether they had undergone vaginal examination at that visit, including assessment of pelvic floor strength and pelvic floor exercise advice.

Study III To investigate the prevalence and effect of UI and its impact on primiparous women's daily activities, in addition to its impact on psychological health and wellbeing, 9-12 months postpartum.

Study IV To investigate to what extent posterior compartment specific symptoms, such as bowel-emptying difficulties or AI, occur after second degree tears in comparison to no or first-degree tears related to second-degree perineal tears 9-12 months after uncomplicated vaginal delivery. Furthermore, to investigate these symptoms impact on women's daily activities, in addition to its impact on psychological health and wellbeing.

4 METHODS

A brief overview of the subjects and methods in the four studies is presented below.

Table 3 Overview of the studies and methods

	Design	Data Sources	Participants	Analysis
Study I	Mixed method with an experimental, explanatory, sequential design	All 597 women Included in the MIMA project	496 primiparous women, 241 in the intervention group and 255 controls	Descriptive statistics Logistic regression Qualitative content analysis
Study II	Cohort study		461 primiparous women	Descriptive statistics Pearson Chi-Square test
Study III	Cohort study		410 primiparous women	Descriptive statistics Pearson Chi-Square test t-test
Study IV	Cohort study		410 primiparous women primiparous	Descriptive statistics Pearson Chi-Square test

4.1 SETTING

The data in this thesis is based on data from the MIMA (Midwives' Management of the Second Stage of Labour) study, an experimental study conducted between November 1, 2013 and February 16 2015 (96). The study was conducted at two different labour wards in Stockholm, Sweden, that respectively managed 6,500 and 4,100 births annually.

Intervention: the MIMA model of care

The MIMA model of care, based on the theoretical framework of woman-centred care (97), comprises three components:

- Spontaneous pushing: the woman acts upon her strong urge to push; she follows the urge, but without any extra abdominal pressure. If needed, she is assisted to

achieve a controlled and slow delivery by the midwife encouraging her to breathe and resist the urge to push.

- Flexible sacrum positions: the pelvic outlet is enabled to expand by birthing positions allowing flexible sacro-iliac joints (all fours, standing, lateral, kneeling or sitting on the birthing stool) (42).
- As a result of applying the two-step technique of head-to-body birthing, the baby's head is delivered slowly (32), meaning that it is born either between contractions or at the end of a contraction, followed by the shoulders during the following contraction.

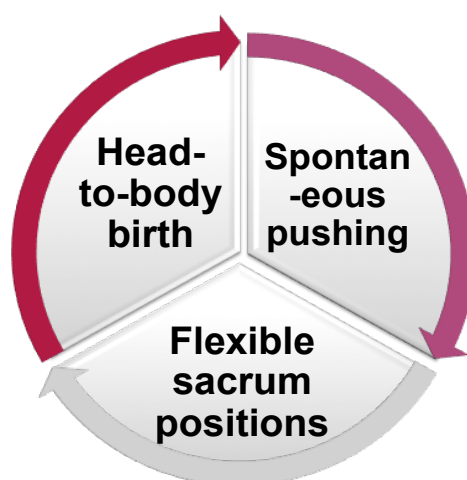


Figure 2 The MIMA model of care

The midwives attending the study's intervention group were instructed to implement all three MIMA components during delivery. However, this was only carried out in 18.0% of the intervention group. Furthermore, 5.7% in the standard care group were also managed with all three MIMA components ($p < 0.001$) (96).

Standard care for the control group

Women in the control group were given standard care by the attending midwife. Midwives in Sweden do not ordinarily document standard care during the second stage of labour in detail. There are no national guidelines for pushing methods, birth positions or perineal protection methods. As a result, management of the second stage of labour depends on the midwife's knowledge, preferences and experience. One theory, based on research and clinical experience, is that, due to high rates of epidural analgesia and semi-recumbent or supine birth positions, standard care at a woman's first delivery mainly entails directed pushing (39). Another assumption, derived from the same research, is

that numerous midwives prefer to encourage the woman to birth the baby's head and shoulders in one single contraction due to fear of shoulder dystocia and endangering the baby (98).

Assessment in both MIMA and control groups

After the birth, midwives used a sterile instrument marked in cm to measure the perineum and the length of any tears. The attending midwife measured the tear together with a co-worker (another midwife, or an obstetrician), after which she filled out the study protocol. The perineal injury was classified according to the RCOG international standards (Table 1) (24). The above-mentioned Swedish classification was also used (Table 2) (25). Injuries were thus classified as minor, second-degree, or severe Second-degree tears and divided, according to the classification, into type-I moderate injury (2a or 2b) or type-II moderate injury (2c) (25).

4.2 STUDY DESIGN AND DATA COLLECTION

Study I was a mixed method study with an experimental, explanatory, sequential design (99). We wanted to explore different aspects of postpartum haemorrhoid symptoms. Primiparous women were allocated either to the MIMA intervention group or to the MIMA control group. All 597 women participating in the MIMA project were given a study-specific questionnaire (QI) three weeks after the birth, covering symptoms during the postnatal period, and a second study-specific questionnaire (QII) 1.5 year after delivery, addressing different aspects of remaining haemorrhoid symptoms. A flowchart of the population is shown in Figure 3.



Figure 3 Flowchart of Study I

In the prospective cohort Studies II, III and IV, the data were based on QIII, covering different aspects of PFD. This questionnaire was sent to all women included in the MIMA project 12 months after delivery. A flowchart (Figure 4) shows the number of women eligible for inclusion in Study II. QII covers long-term symptoms of perineal pain related to perineal injuries three, six and 12 months after birth, as well postnatal care. The data were retrieved from the questionnaire responses and related to the degree of perineal injury recorded in the study protocol (96).

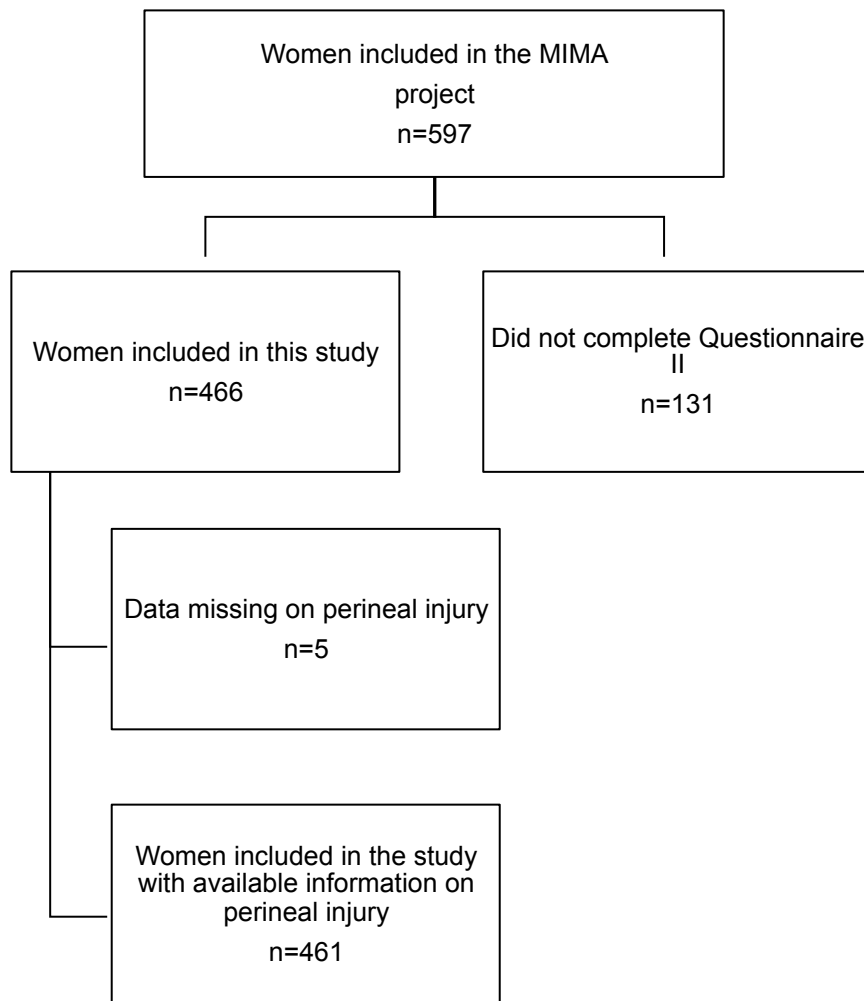


Figure 4 Flowchart of Study II

The questions in QIII covered UI and its impact on women's daily activities, psychological health and wellbeing 9-12 months postpartum. We excluded women reported being pregnant again (n=56) from this study. In Study IV, we investigated whether bowel-emptying difficulties and AI were more prevalent in women with larger second-degree tears than in those with less severe tears. Figure 5 shows the population in Studies III and IV.

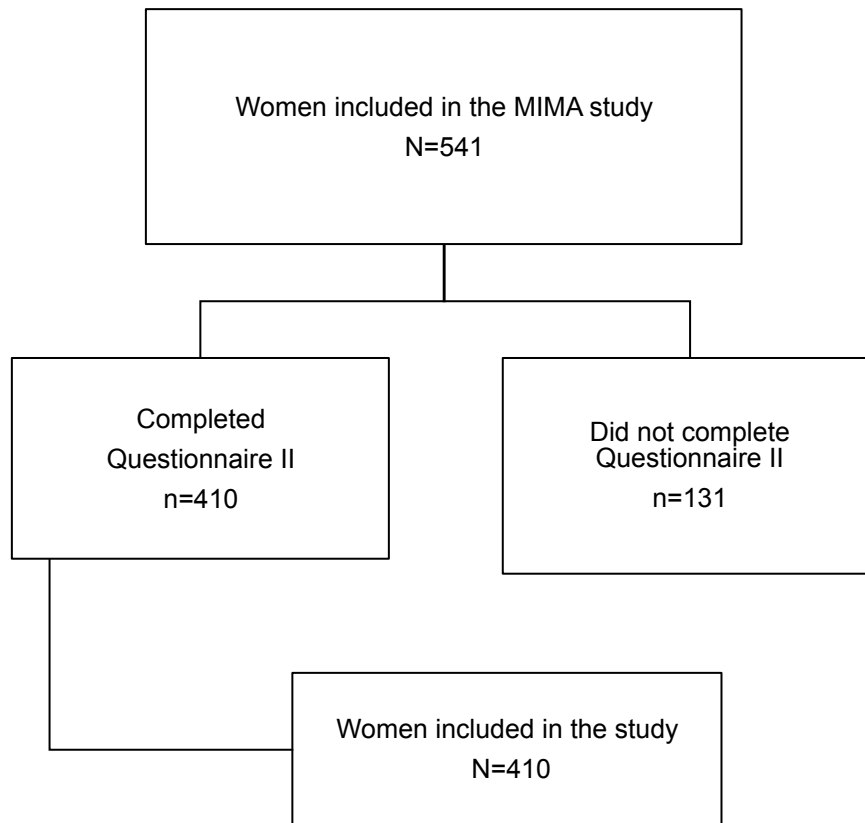


Figure 5 Flowchart study III and IV

4.2.1 Study population

The women included in Studies I-IV, all with spontaneous onset or induction of labour, were primiparous and swedish speaking and had a gestational age of $\geq 37+0$ weeks. Women with preterm birth ($\leq 37+0$ weeks), diabetes mellitus (pregnancy-induced or manifest), female genital mutilation, intrauterine growth restriction, stillbirth, breech presentation or multiple pregnancies were excluded. Furthermore, we excluded women with multiple pregnancies and those who were pregnant again within the first year postpartum from Studies III and IV.

4.2.2 Questionnaires

QI, used in Study I, was distributed by post with a prepaid return envelope three weeks after delivery. The first five questions concerned background characteristics (country of birth, level of education, marital status and tobacco use), followed by two questions about pregnancy and nine birth-related items.

QI also included items concerning experiences during the second stage of labour and the healing of perineal injuries. These questions were taken from the previously validated CEQ (Childbirth Experience Questionnaire), assessing different aspects of maternal

satisfaction with labour and birth) (22 items) (100), from the Swedish Women's Experiences of Childbirth national cohort study (13 items) (101) and from Olsson et al. regarding symptoms in the postnatal period (6 items) (102). In total, the questionnaire consisted of 57 items and was 13 pages long. It was validated face- to-face with six women one year after giving birth to their first child.

QII was a study-specific questionnaire, developed by our research group. It was sent by post with a prepaid return envelope 1.5 years after delivery. The women were asked about the prevalence and duration of any remaining haemorrhoid symptoms, whether they had seen healthcare professionals for these problems and, if so, what kind of help they had obtained. One item was an open-ended question with no limit on response length: "Please write freely if there's something you want to convey to healthcare providers about having haemorrhoids after childbirth". The questionnaire contained 12 items and was two pages long. It was validated face- to-face with five women 1.5 years after giving birth to their first child.

QIII started with six questions about background characteristics, i.e. height and weight, level of education, marital status and tobacco use, followed by seven questions about postpartum care and pregnancy, nine questions about the birth experience and general health (101). It also included five questions about the care provided during the postpartum check-up 6-12 weeks postpartum. Furthermore, there were two questions on perineal pain and three questions on UI, AI and sexual function, taken from the previously validated Pelvic Organ Prolapse/Urinary Incontinence Sexual Questionnaire (PISQ-12) questionnaire, as well as nine questions derived from the Pelvic Floor Distress Inventory (PFDI-20) which includes the Urinary Distress Inventory 6 (UDI-6) (103). Four questions addressing AI and bowel-emptying difficulties from the Danish Anal Sphincter Rupture Questionnaire were also included (104). An additional seven questions about UI and AI and their impact on daily activities, psychological health and wellbeing came from the Pelvic Floor Impact Questionnaire PFIQ-7 (103). In total, QIII consisted of 52 items and was 11 pages long. It was validated face- to-face with 12 women one year after giving birth to their first child.

4.3 OUTCOMES

The outcome variables in Study I were haemorrhoid symptoms in relation to management of the second stage of labour, as well as the prevalence and duration of remaining symptoms 1.5 year postpartum. The primary outcome in Study II was

perineal pain related to vaginal tearing, and the secondary outcomes were uptake of postnatal check-up and rates of vaginal examination, pelvic floor strength assessment and pelvic floor exercise advice. The primary outcome in Study III was women's self-report of any degree of UI 9-12 months after birth, related to duration of the second stage of labour. The impacts of UI on women's daily activities and psychological wellbeing 9-12 months postpartum were secondary outcomes. In Study IV, the primary outcome was the occurrence of symptoms such as bowel-emptying difficulties and AI, including soiling and flatus incontinence related to the degree of perineal injury. The impact of these symptoms on women's daily activities and psychological health 9-12 months postpartum was a secondary outcome.

4.4 DATA ANALYSIS

In all four studies (I-IV) descriptive statistics were used to present the quantitative and background characteristics (n, percentage, median and mean). Pearson's Chi-Square test or Fisher's Exact test was used for analysis of the respective associations between the categorical variables and potential differences concerning previously known risk factors, such as BMI, age, duration of the second stage of labour, birth weight and haemorrhoids during pregnancy, in the intervention and control groups. Corresponding associations concerning the severity of perineal injury and the severity of perineal pain at three, six and 12 months postpartum were analysed, as were the occurrence of UI, AI and bowel-emptying difficulties 12 months postpartum.

In Study I, Odds Ratios (OR) with 95% confidence intervals (CI) were calculated. Logistic regression was used to adjust for potential confounders differences between the dependent variable, i.e. haemorrhoid symptoms three weeks postpartum, and the risk factors haemorrhoids during pregnancy, birth weight, BMI and age. The initial quantitative phase in Study I was followed by a second, qualitative, analysis phase contributing to explain the quantitative results (105). The analysis method applied during this phase was qualitative content analysis, as described by Graneheim and Lundman (106). This method involves a step-by-step interpretation process, based on how thoughts and experiences are expressed in the text. In order to obtain an overall perspective, the text was read thoroughly several times. Thereafter, meaning units were extracted and condensed into shorter units with a higher degree of abstraction into codes, subcategories and categories, followed by the creation of a theme.

In Study III, Independent Samples t-tests were used to compare means for birth weight, head circumference and rates of UI, AI and bowel-emptying difficulties. UI and AI and their respective impacts on daily activities, relationships and psychological wellbeing were analysed separately and as composite variables. p-values equal to or lower than 0.05 were considered statistically significant.

5 ETHICAL CONSIDERATIONS

The studies were conducted according to the Ethical Guidelines for Nursing Research in the Nordic Countries (Nordic Nurses' Federation, 2003)(107) and the Ethical Principles adopted by the ICM (International Confederation of Midwives, 2014) (108). The former are based on the Helsinki Declaration (World Medical Association, 2018) (109). All four studies were approved by the Ethics Committee at Karolinska Institutet in Stockholm (Dnr 2013/859-3/2).

The research project took into consideration the four main ethical principles for medical research included in the Helsinki Declaration: respect for autonomy, beneficence, non-maleficence and justice (110). Respect for autonomy includes the individual's right to decide about participation in the study, protecting the potentially vulnerable individual's dignity and integrity.

Non-maleficence was also taken into consideration. Participants received both written and oral information about the study from the attending midwife at the labour ward. All women participating in this study had given written consent to participate in the MIMA project, and accepted that additional data would be drawn from their antenatal clinic and delivery ward charts. Confidentiality was protected, as only researchers involved in the studies had access to the collected data. All data were handled according to national law and guidelines and the potential harm to the participants was thus minimal. The ethical principle justice was also taken into consideration; all women that met the predefined inclusion criteria were asked by the midwife responsible for their care whether they wanted to participate, without discrimination related to ethnicity or socioeconomic class. They were informed that they could withdraw their consent at any time, without any consequences regarding care during delivery and the postnatal period. Women who declined participation were treated according to routine practice at that specific facility. It was possible to blind the women because the practices used in the intervention overlapped to some extent with those in standard care.

6 FINDINGS

In this section, the main findings of the four studies are presented. For the complete results, please see the full papers at the end of the thesis.

Study I: Haemorrhoids –a neglected problem faced by women after birth

A total of 496 primiparous women who completed the questionnaire three weeks postpartum participated, 241 in the intervention group and 255 in the control group. The two groups were well balanced; however, the women in the intervention group were slightly younger and had a higher BMI. A majority of the women in the study were married or cohabiting.

Furthermore, there were no differences regarding haemorrhoids during pregnancy, prevalence of complications such as second-degree tears or obstetric variables such as duration of second stage of labour. The women in the intervention group reported less haemorrhoid symptoms three weeks postpartum, compared to the women in the control group (adjusted OR 0.6; 95% CI 0.4-0.9).

Table 4 Socio-demographic background, Study I and II

Socio-demographic background, Questionnaire 1		Socio-demographic background, Questionnaire 2	
	N=496 n (%)		N=461 n (%)
Age mean years	29.9	Age mean years	31.0
Age group years		Age group years	
<25	72 (14.5)	<25	50 (10.8)
25-35	376 (75.8)	25-35	353 (76.6)
>35	46 (9.3)	>35	58 (12.6)
Civil status		Civil status	
Married/Cohabit	484 (97.6)	Married/Cohabit	444 (96.3)
Single or other	12 (2.4)	Single or other	13 (2.8)
		Missing	4 (0.9)
Tobacco use		Tobacco use	
Yes	8 (1.6)	Yes	16 (3.5)
No	453 (91.3)	No	444 (96.3)
Missing	35 (7.1)	Missing	1 (0.2)
BMI in the first trimester		BMI groups one year post partum	
BMI mean	22.1	BMI mean	23.1
<18.5	16 (13.2)	<18.5	18 (3.9)
18.5-24.9	344 (69.4)	18.5-24.9	334 (72.5)
25.0-29.9	82 (16.5)	25.0-29.9	79 (17.1)
>30.0	16 (3.2)	>30.0	22 (4.8)
Missing	8 (1.7)	Missing	8 (1.7)
Level of education		Level of education	
University/ College degree	333 (67.1)	University/ College degree	286 (62.0)
Elementary school/ Upper secondary school	163 (32.9)	Elementary school/ Upper secondary school	132 (28.6)
		Missing	43 (9.3)

A total of 120 women, 51 in the intervention group and 69 in the control group, answered QII. There were no statistically significant differences between women who responded and those who did not concerning age, level of education, smoking, marital

status, prevalence of second-degree tears or duration of second stage of labour. Around half of the women in both groups still had problems with haemorrhoids 1.5 years after delivery (43.1% vs. 56.5%). A majority of these women had experienced severe or very severe problems with haemorrhoids (80.0% vs. 67.6%). Half of the women that had suffered pain from haemorrhoids had used some type of pain-relief medication (56.9% vs. 42.0%).

The content analysis identified one main theme, three categories and ten subcategories, concerning women's experiences and what they wanted to convey to healthcare providers. The main theme encompasses the categories emerging from the responses to the open question, i.e. Impact on the women's quality of life; Attitudes and ignorance; and Missing information. The main theme, "Haemorrhoids after birth, a neglected dilemma in the healthcare system", refers to women's experience of haemorrhoid symptoms as a severe and long-lasting pain problem, as well as an aesthetic and hygienic problem that affected their quality of life postpartum. When they had sought medical care, the women reported having been treated with disrespect and neglected by healthcare providers. They described their experience that haemorrhoid symptoms are perceived as normal. They expressed that there was a lack of knowledge and a need for more or better information from healthcare staff about their symptoms and possible treatment.

Study II: Perineal pain the first year after childbirth and uptake of postpartum check-up, a Swedish cohort study

There were 461 participants in this prospective cohort study. Nearly all were married or cohabiting and were non-smokers (Table 2). More than half had higher education. One in five (20.8 %) had a minor perineal injury, while 67.9 % had a type-I moderate injury (2a, 2b), and 7.6% had a type-II moderate injury II (2c). The incidence of severe perineal injury (3a, 3b, 3c and 4) was 3.7%.

The severity of perineal injury was related to the occurrence of perineal pain during the first year postpartum. At three months postpartum, a majority (75.0%) with severe injuries, more than half (61.8%) with type-II moderate injuries, and 44% with type-I moderate injuries reported perineal pain ($p < 0.002$). Perineal pain at six months postpartum was reported by 60% with severe injuries, by 38.7% with type-II moderate injuries and by 21.5% of those with type-I moderate injuries ($p < 0.001$) (Figure 6).

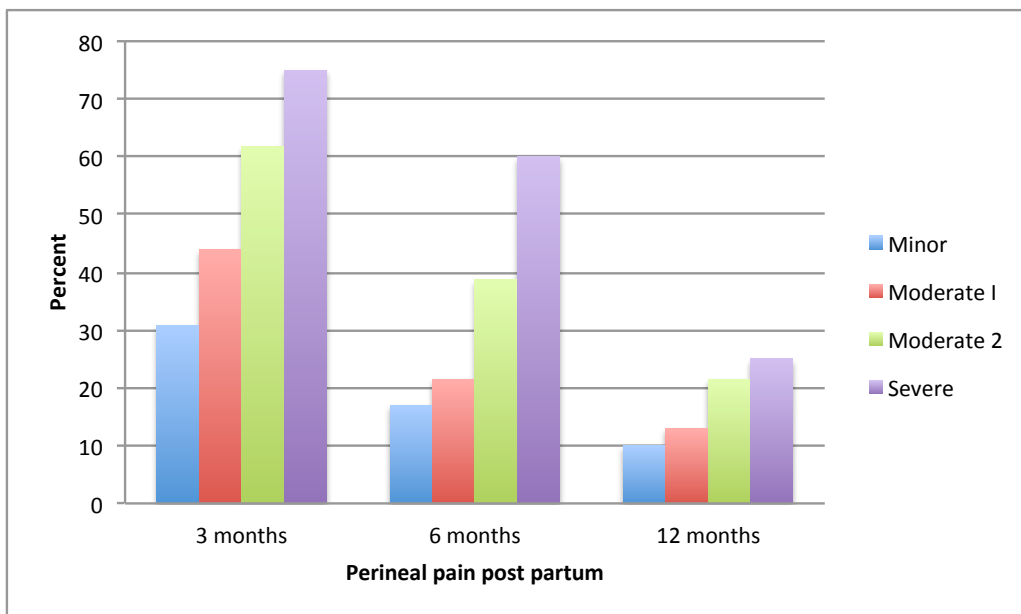


Figure 6 Occurrence of perineal pain, associated with severity of perineal trauma

Nearly all women attended their postpartum check-up. One in four did not undergo vaginal examination at the check-up. Midwives performed vaginal examinations in 70.6 % of women with severe injuries, in 85.3% with type-II moderate injuries, in 80.3% with type-I moderate injuries and in 68.5% of those with minor injuries. The women's pelvic floor strength was assessed in a higher proportion in cases with type-I moderate (77.8%), type-II moderate (75.0%) or severe (73.3 %) injuries, compared to those with minor injuries (64.4 %). Moreover, almost two-thirds of the women were given advice about pelvic floor exercises.

Study III: Urinary incontinence after uncomplicated spontaneous vaginal birth in primiparous women the first year after birth, and **Study IV:** Posterior compartment symptoms in primiparous women one year after non-instrumental vaginal deliveries – a Swedish cohort study.

A total of 541 women were included in Studies III and IV and 410 completed the questionnaire one year after giving birth. The median age was 31.0 years and the median BMI was 23.0. There were no statistically significant differences between women who completed the questionnaire and those who did not regarding BMI, severity of perineal injury, duration of the second stage, birth position or the baby's birth weight or head circumference. When it came to age and smoking habits, there were statistically significant differences between responders and non-responders, i.e. the non-responders were younger and smokers to a higher extent.

In Study III, nearly 40 % had UI 9-12 months after birth. SUI was the most common

type (45.4%), while 38.0% had UUI and 27.0% of the women reported MUI symptoms. Obstetric variables, such as duration of the second stage, the baby's head circumference and birth weight and the degree of perineal tears, were not associated with the prevalence of UI. The women whose UI affected their daily activities negatively reported significantly impaired psychological wellbeing. Half of the women in the study reported that their symptoms caused mild inconvenience, while one in five reported severe discomfort. We found no statistically significant association between SUI, UUI, MUI and long second stage of labour. Birth weight and head circumference had no impact on SUI, UUI or MUI rates.

A majority (73.2 %) reported that their UI symptoms had no impact on their daily activities, relationships or mental health. However, almost a third (32.1%) of the women who reported that their symptoms did impact negatively on their daily activities reported a low level of psychological wellbeing during the preceding three months, compared to only 5% of the women who reported no such negative impact ($p < 0.001$).

In study IV women with second-degree tears, 18.9 % had bowel emptying difficulties compared to 20 % of women with minor tears, while the corresponding prevalence for flatal incontinence were 38.4% and 32.9% respectively. Furthermore, 2.9 % of women with a second-degree tear complained of anal incontinence (AI) of formed stool, 7.1 % of AI of loose stool in comparison to 1.2 % and 3.5 % in women with minor tears. There was an association between reported negative impact on daily activities and more negative psychological wellbeing. Out of 23 women reporting any impact on their daily activities, 60.9% also reported impact on their psychological health, compared to 7.6% among the 381 women not reporting any impact on daily activities ($p < 0.001$).

7 DISCUSSION

7.1 DISCUSSION OF METHODS

The study population in this thesis was derived from the MIMA project, an experimental study to which primiparous women who fulfilled the inclusion criteria were individually recruited on admission to the delivery ward (96). One strength of the study design is that the midwives in the intervention and control groups worked different shifts, i.e. night and day shifts, respectively, at one department, and vice versa at the other department contagion between the groups was thus avoided (111). The midwives documented the delivery process in the medical records text, as well as depicting ruptures in an anatomical drawing. The participants were c as to which group they belonged to. This was possible since the intervention did not aim at testing a new method, but rather the combined effects of previously existing managements.

Participants were women giving birth to their first baby at one of two delivery wards in Stockholm. The catchment area population is a relatively homogeneous group, characterized by higher socioeconomic status and education level, compared to the general population. However, the literature provides no reason to assume that socioeconomic factors affect the studied symptoms. Almost 28% of women giving birth in Sweden were born in another country. Previous research has shown that immigrant women can be given suboptimal care, compared to that provided to swedish-born women, and that culture may be associated with preferences and risk factors (112). The inclusion criterion of understanding enough swedish to fill out the questionnaires thus limited the generalizability of our findings.

The cohort in these studies is a relatively large group of primiparous women in a population who underwent normal deliveries. One strength is the respective application of mixed method (Study I) and cohort (Studies II-IV) designs. Different analysis methods enabled us to approach the overarching aim from different angles.

No statistically significant associations were found when the respective associations between the MIMA intervention and UI, AI and perineal pain were evaluated with Pearson's Chi-square test. Thus, we did not adjust for the intervention-control group in Studies II-IV.

7.1.1 Data collection methods

The use of questionnaires made it possible to obtain data from a relatively large number of women. Filling in a questionnaire anonymously can be perceived as an advantage by the participant who is thus not required to openly describe feelings and experiences (113). However, more profound insight into the subjective experience of symptoms and the care provided may have been lost by the use of closed response alternatives. We therefore chose to also use open-ended questions, eliciting more elaborate responses that provided additional information about the respondents' experiences.

7.1.2 Validity

Randomized controlled trials (RCT) are considered to entail the highest degree of validity since the design makes it possible to minimise the risk of systematic and random errors (114). None of the studies in this thesis were RCT and they were all, to varying extents, affected by systematic errors.

7.1.3 Confounders

Confounding can be considered a confusion of effects. The apparent effect of the exposure of interest is distorted because the effect of an extraneous factor is mistaken for or mixed with the actual exposure effect (114). Potential confounders for PFD after delivery are correlated with many of the exposures and outcomes we studied. We adjusted for potential confounders such as age, marital status, education level and haemorrhoid symptoms during pregnancy, by logistic regression. Thus, we cannot rule out that other confounders may have affected our results. However, adjustments should be made for robust theoretical reasons and cautiously, in order to avoid differences between groups being "erased" in the analysis (115).

7.1.4 Loss to follow-up

Loss to follow-up can introduce systematic errors and lead to over- or underestimation of effects. The respective response rates in our studies were 82.1% and 70.0% (Study I), 77.0% (Study II) and 75.7% (Studies III and IV) of the total number of MIMA participants. This relatively high response rate, in addition to the fact that non-responders' and responders characteristics did not differ, can be assumed to increase the validity and enable generalizability of the findings. Strategies to additionally increase the response rate were text message reminders after two weeks, sending out a new questionnaire on request and a member of the research team being available by phone to answer any questions (116). It can, however, not be ruled out that the loss to follow-up

affected results since women with severe symptoms or negative experiences may have refrained from responding. On the other hand, women with no symptoms may also have refrained from responding, as they might not have felt the need to be followed up (113).

7.1.5 Misclassification

The questionnaires were validated in several steps. They included questions that had been validated in previous studies, as well as study-specific questions created by our research team and tested face-to-face for validity. Content validity consists of experts confirming that a test is a valid measure of the concept being measured (113). Women who had given birth to their first baby three weeks (QI) or one year (QII and QIII) earlier, the experts in this case, responded in the presence of a member of the research group. The purpose was to investigate how the questions and their relevance were perceived and whether they addressed what they were intended to assess. There are advantages and disadvantages to including questions formulated by the researchers in a questionnaire study. One advantage is the possibility to ask exactly what they want to know. The disadvantage is that the questions can be misunderstood by the participants. Most questions in the studies were, however, taken from validated questionnaires previously used to investigate women's experiences of PFD (103).

7.1.6 Recall bias

Memory can be a source of error and perception of symptoms can change over time. These studies are based on self-reported previous pelvic floor symptoms and thus carry a risk of recall bias. As mentioned above, data collection consisted of enquiring about the occurrence of haemorrhoid symptoms three weeks and 1.5 year postpartum, about perineal pain three, six and 12 months postpartum, as well as about UI and AI 9-12 months postpartum. The fact that birth is a challenging and emotional experience accompanied by strong feelings may also have had an impact on the results (117).

7.1.7 Study I

This study had a mixed-method design, generating advantages connected to both quantitative and qualitative designs. Combining the methods is advantageous since the quantitative data contribute to the possibility to make comparisons between groups, while the qualitative data provide more nuanced content (118). The chosen method provides more extensive knowledge, as well as the opportunity to study women's experience of haemorrhoid symptoms postpartum. The women's responses to the open-ended question in QII enhanced the responses and contributed to more extensive results.

As mentioned above, we cannot rule out that negative experiences might have been a reason not to respond. In order to counteract this possibility, we used representative quotes and we sought consensus within the research group concerning similarities and differences (106). This last component of the analysis was repeated several times.

No causal relationship can be established between the MIMA model of care and preventing or decreasing the prevalence of haemorrhoids, due to the risk of bias. The results of the experimental study showed that implementation of all parts of the multifactorial MIMA intervention was carried out in 18% (96). However, both the intervention and the standard care group were similar with regard to obstetric variables, and the differences in maternal characteristics were adjusted for possible confounders and known risk factors for symptomatic haemorrhoids postpartum, i.e. haemorrhoid symptoms during pregnancy, age, birthweight and BMI.

7.1.8 Study II

We used a dichotomised yes-or-no question to assess the prevalence of perineal pain. We could have used questions estimating pain level, for instance with the Numerical Rating Scale (NRS), the Visual Analog Scale (VAS) or the Verbal Rating Scale (VRS) (119), which might have yielded important knowledge. According to the IASP definition, pain refers to an experience and it is always subjective (72). This definition has been criticised since it excludes other dimensions such as the emotional, cognitive and social components of pain. In order to better reflect the subjective phenomenon, it has been suggested that the definition be expanded to "pain is a distressing experience associated with actual or potential tissue damage, with sensory, emotional, cognitive and social components" (120). Childbirth is a central event in life that can affect the woman's future wellbeing, the baby and the relationship between the woman and her partner (121). The body undergoes changes during pregnancy and the postpartum period impacts on women's identities and their relationships with their environment (122). The postpartum period also entails major changes for the woman and it can be difficult to assess pain on a scale since it is so subjective and individual. It is thus perhaps not misguided to use a yes-or-no question. However, qualitative methods should be included in future research in order to correctly reflect prevalence and women's experiences of perineal pain.

7.1.9 Studies III and IV

The variation in UI definitions underlies the major divergence among reported estimated prevalences (115, 116), and limits the possibility to reach an exact and epidemiologically useful definition, in turn leading to difficulty estimating the actual prevalence. In Study III, in which the updated IUGA/ICS definition (43) was applied, we found a high prevalence of UI.

The PFIQ-7, the PFDI-20 and the Danish anal sphincter rupture questionnaire were the primary sources of data. The strength of these questions was the obtained extensive impression of the effects of PFD on quality of life, rather than only one aspect. However, dichotomized response alternatives make it impossible to answer "a little", and it is possible that this led to loss of information or to misclassification (123).

7.2 DISCUSSION OF RESULTS

When investigating and evaluating short- and long-term symptoms of PFD postpartum, we found that several symptoms are common and persist after birth. Many first-time mothers experienced perineal pain, UI, AI and bowel-emptying difficulties during the first year and symptoms from haemorrhoids during the first 1.5 year after birth. Only one-third of the women reported no such symptoms. We also found that these symptoms affected women's daily life and psychological wellbeing.

7.2.1 Different effects of pelvic floor dysfunction

Earlier research has found that women experienced PFD as more severe than they had expected (124), and that they suffer much more from haemorrhoids during the first year postpartum than they had anticipated. Nearly half of the women in this study that suffered from haemorrhoids three weeks after delivery reported that they still had symptoms 1.5 years later. Their symptom degree varied from mild inconvenience to severe impact on daily life.

We found that for a large number of women, perineal pain persists during the first year postpartum, and that the occurrence of pain may be related to the severity of perineal injury. This finding concurs with previous findings (73) that women with extensive trauma suffer more pain than women sustaining less severe trauma. On the other hand, a recent meta-analysis evaluating the effect of intact perineum and first- or second-degree perineal trauma on perineal pain concluded that women with an intact perineum rated pain during the first three months postpartum similarly to women who had sustained perineal trauma (125). Second-degree tears vary in depth and complexity, indicating that

they require sub-categorization or regrouping, including according to LAM damage, in order to improve understanding of perineal pain related to childbirth (73).

Many primiparous women seem to be at risk of UI 9-12 months after their first delivery. It has been noted in previous research that women consider UI to be a normal occurrence related to childbirth. They may not seek help from the healthcare system, probably contributing to the underreporting of symptoms (95). We found that nearly half of the women suffered from SUI 9-12 months postpartum. Furthermore, nearly half of the women with UI reported that their symptoms caused mild inconvenience, and one in five reported that their symptoms caused severe discomfort. Almost a third of the women who reported that their symptoms had a negative impact on their daily activities reported a low level of psychological wellbeing. Women with UI are also considered more likely to suffer from AI (126).

Earlier research has found that the strongest predictor for AI one year postpartum is AI in the third trimester of pregnancy (55). The fact that AI is reported by women in the third trimester of pregnancy suggests that it is not simply the trauma of vaginal birth, but pregnancy itself, that leads to AI (56, 126). It was, however, beyond the scope of these studies to investigate the role of pregnancy or other factors, such as LAM injury.

Nearly one in five of the women had bowel-emptying difficulties and three percent reported AI 9-12 months after birth in our study. When it came to flatal incontinence, we found that women with second-degree tears had complaints to a similar extent as those with anal sphincter injuries. Our findings demonstrate that women with minor and second-degree tears may have complaints of pelvic floor disorders comparable than those with obstetric anal sphincter tears.

7.2.2 Symptoms regarded as normal or dismissed

The length of time women spend in hospital after birth has fallen dramatically in developing countries since the 1970s (89). As mentioned above, the delivery hospital is responsible for the woman's care during the first week postpartum and women with first- or second-degree tears are followed up by the antenatal care midwife at the postpartum check-up 6-12 weeks after birth (88). However, there is a lack of continuity and opportunity for follow-up between and after these visits (92).

Furthermore, we found that women who had sought medical care often felt that they had simply been dismissed. Earlier studies have reported that the absence of qualified

assessment after birth causes women to believe that a perineal injury is severe, regardless of the actual degree (87, 127). On the other hand, women sometimes dismiss birth injuries as normal in an attempt to deal with the problems they cause. They may also believe that their symptoms are a natural consequence of giving birth (78, 83) and many feel that the focus is on the baby and its health. They do not know whom to turn to and dare not address their problems (128). Physical recovery, and the psychological changes required to meet the baby's needs, can make the first 1.5 year postpartum a time of heightened vulnerability, especially for first-time mothers.

Women in our study reported that haemorrhoid symptoms during the first 1.5 year postpartum were often described as normal by healthcare staff. These issues have rarely been investigated previously, as they are often regarded as negligible and likely to improve over time (124). We found that the haemorrhoid symptoms were regarded by women as an intimate and sensitive problem. Despite their pain, few women used pain-relief medication, raising the question of whether they knew where to seek help during the first three weeks after birth. They expressed a need for more or better information from the healthcare system about their symptoms and about available treatment for haemorrhoids. The women who had not recovered from haemorrhoid symptoms, 1.5 years after their first delivery thought that their problems would never disappear.

One in ten women with moderate injuries in our study still reported perineal pain after one year. Nearly all women attended the postpartum check-up and three of four of these underwent vaginal examination. Among the examined women, those who had sustained a severe or moderate injury had their pelvic floor examined to a higher extent, compared to those with minor injuries. As was the case with haemorrhoid symptoms, women with failed to receive adequate treatment (128).

UI and AI also affected women's daily activities negatively and significantly impaired psychological wellbeing. Nearly half of the women reported that their symptoms caused them mild inconvenience, and one in five reported severe discomfort. Women suffering from AI rarely seek help and hide their symptoms for several reasons, including stigma. They believe that AI is a normal consequence of birth and accept that they may have to live with the symptoms (129-131). Women with AI do not talk about these symptoms unless they are asked directly, which few healthcare practitioners do (132), described in previous research, and experienced by many women, as a "professional silence" (130, 133).

7.2.3 Studied obstetric variables do not affect the prevalence of UI

In this study, 40% of the women had UI 9-12 months after birth, with SUI as the most common type. Data on the different types of UI one year postpartum after vaginal birth in primiparous women are sparse and, as mentioned above, most published studies have evaluated UI as an entity, without addressing the different types (134, 135). One previous literature review reported that the prevalence of UI decreases shortly after birth (136), while others studies have found that it remains high during the first year postpartum (137). Contradictory results have also been reported regarding obstetric and neonatal parameters as risk factors for UI. In this study, we found no correlation between women's reported prevalence of UI 9-12 months postpartum and the duration of the second stage of labour or the baby's head circumference or birth weight. These findings are consistent with previous studies; prolonged second stage of labour (138, 139), perineal injury (73, 140), birth weight (138, 139, 141) and head circumference (140) seem to be of minor importance for the risk of UI postpartum.

SUI is the most prevalent form of UI related to birth and may be the result of a failing pelvic floor, sphincter and/or supportive system (134). Previous research focusing on changes during pregnancy and after birth in primiparous women has found that genetic factors, such as inborn weakness of pelvic floor structures, may predict SUI postpartum (14). Furthermore, several studies have suggested that the likelihood of SUI after birth is higher among primiparous women if it begins during pregnancy (14, 139). This could be explained by physiological changes, i.e. decreased pelvic floor muscle strength, beginning at 14 gestational weeks, or by increasing levels of the circulating hormone relaxin. Moreover, increased intraabdominal pressure due to the weight of the growing uterus, together with high progesterone levels and changed collagen structure, may lead to overload of the pelvic floor muscles and ligamentous structures. These mechanisms increase the urethrovesical angle, and therefore contribute to SUI because of bladder neck mobility (13). Previous research has showed that women with ultrasound-verified urethral descent are at risk of SUI one year postpartum, regardless of mode of delivery (137). Our findings support the probability that it may be the pregnancy itself, i.e. physiological changes, hormonal changes and genetic factors, that may at least partly explain the development of SUI. This knowledge about risk factors implies that women at risk of UI might be identifiable during pregnancy or at the postpartum check-up.

8 CONCLUSIONS

A slow birth of the baby's head, in combination with spontaneous pushing in a position that relieves the pressure from the pelvis, may be protective for haemorrhoid symptoms three weeks after delivery in primiparous women. Furthermore, women experiencing haemorrhoid symptoms three weeks after delivery are at high risk of having remaining symptoms 1.5 year postpartum. Women in our studies felt that they did not receive adequate healthcare, and expressed the need for developed and improved care for these symptoms.

Self-reported perineal pain one year postpartum was related to severity of perineal injury, and pain is frequent among primiparous women with moderate injuries. More than one in ten women suffered from perineal pain one year postpartum. One in four primiparous women suffered from urinary incontinence 9–12 months postpartum, creating a negative impact on their daily activities. Our study also indicates that onset of urinary incontinence and anal incontinence may occur already during pregnancy.

Symptomatic pelvic floor dysfunction is not exclusive to women suffering obstetric anal sphincter injuries. Second-degree tears may generate a wide range of symptoms, an issue which must be addressed in order to prevent, diagnose and manage pelvic floor dysfunction and improve women's quality of life after giving birth. Primiparous women sustaining minor or second- degree tears had bowel-emptying difficulties and anal incontinence 9-12 months postpartum to the same extent as women sustaining tears involving the anal sphincter complex. We also found that urinary incontinence and anal incontinence have an impact on women's daily activities, significantly affecting their psychological health.

Women with moderate or minor perineal injuries might have complications during the first year after childbirth that are as severe as for women with anal sphincter injuries. Optimal care from the midwife during labor and childbirth can reduce some symptoms but further research is needed in order to improve care and treatment for women after birth to their first child.

9 CLINICAL IMPLICATIONS

Our findings highlight the importance of devoting attention to women's symptoms and suffering, regardless of the severity of perineal injury. It is essential that obstetric healthcare professionals recognize that PFD is not only limited to women with severe perineal trauma, but may also affect those with moderate injuries. Appropriate postpartum care may thus require increased knowledge about symptoms and treatment options.

Pregnancy and the postpartum period provide a window of opportunity for health promotion. All women should be asked about PFD symptoms during pregnancy, as symptoms may occur both during pregnancy and postpartum. For many women, the symptoms persist 1.5 year postpartum, indicating that development of follow-up care after the routine postnatal check-up is required.

10 FUTURE PERSPECTIVES

There is a further need for studies on various degrees of perineal trauma and PFD after birth, with particular focus on symptom severity, the use of pain relief and the impact on the quality of life for the woman and her family, in the short- and long-term perspectives.

More knowledge is needed about midwives' and obstetricians' perceptions of the severity of the various forms of PFD investigated in these studies.

Studies of the structures and tissues involved in PFD is required in order to better understand the associations, as well as the lack thereof, between symptom severity and degree of injury.

Future studies on PFD should include women from different social and cultural backgrounds, as they may have risk factors and symptoms related to PFD that differ from those in our study population.

Care for women with PFD related to pregnancy and childbirth must also be developed with new, digitalised working methods.

11 SUMMARY IN SWEDISH

När en kvinna föder sitt första barn är det vanligt att hon får någon form av bristning i bäckenbottens muskulatur och slemhinna. Bristningar som kan orsaka problem.

Kvinnors hälsa och symtom relaterade till skador i bäckenbottens muskulatur och slemhinna efter förlossningen och det första året efter barnets födelse, är ett område där det finns kunskapsluckor. Tidigare forskning har övervägande fokuserat på skador på analsfinktern. Det finns begränsad kunskap om kort- och långsiktiga besvär efter bäckenbottensskador, såsom hemorrojder, perineal smärta, tarmtömningsbesvär, avförings- och urininkontinens och hur det kan påverka kvinnors hälsa och livskvalitet.

Denna avhandling syftar till att undersöka och utvärdera bristningar efter en förlossning och konsekvenserna för kvinnor efter deras första barns födelse, fram till 1,5 år efter förlossningen. Avhandlingen baseras på 597 förstföderskor som deltog i MIMA-projektet (Midwives management, during second stage of labour). MIMA är en modell som innebär ett långsamt framfödande genom spontan krystning i en förlossningsställning som möjliggör flexibilitet i bäckenet i kombination med att kvinnan föder fram barnets huvud på en värk och barnets kropp på nästkommande värk.

Studie I syftade till att undersöka förekomst och kvinnors upplevelser av hemorrojder tre veckor och 1.5 år efter förlossningen i förhållande till handläggningen under utdrivningsskedet. Hälften av de kvinnor som hade symtom tre veckor efter förlossningen hade kvarvarande besvär 1.5 år senare. Dessa kvinnor kände sig försummade och avvisade av hälso- och sjukvården.

Studie II syftade till att undersöka förekomst av perineal smärta relaterat till perineal skada, tre, sex och 12 månader efter förlossningen. Vidare studerades vilken vård kvinnor fick vid efterkontrollen. Studien är en kohortstudie där 461 kvinnor deltog. Resultaten visar att svårighetsgraden av perineal skada påverkade förekomsten av perineal smärta under det första året efter förlossningen.

Tre månader efter förlossningen hade cirka 62% (2c) respektive 44% (2a+2b) med måttlig skada, perineal smärta. Vid sex månader efter förlossningen hade förekomsten av smärtan minskat men fortfarande beskrev 39% (2c) respektive 22% (2a+2b) av kvinnorna med måttlig skada att de upplevt smärta. Efter ett år upplevde en av tio kvinnor med mindre måttlig skada (2a+b) att smärtan kvarstod. För en av fyra kvinnor genomfördes inte vaginal undersökning och gavs inga råd avseende övningar för att stärka bäckenbotten i samband med efterkontrollen.

Tabell 5 Ett nytt svenskt klassificeringssystem (25)

Bristning av första graden	Bristning i labia, perineala huden och vaginalväggen med ett djup på mindre än 0.5cm
Bristning av andra graden	Grad 2a: del av perinealkroppen (0.5-2cm) och < 4 cm in i vagina
	Grad 2b: hela perinealkroppen utom sfinktrar eller > 4 cm lång vaginal bristning
	Grad 2c: hela perinealkroppen utom sfinktrar och > 4 cm lång vaginal bristning

Studie III och IV syftade till att undersöka förekomsten av urininkontinens (UI), samt tarmtömningssvårigheter och anal inkontinens (AI) relaterat till faktorer kopplat till förlossningen och dess inverkan på kvinnors dagliga aktiviteter, liksom inverkan på psykisk hälsa och välbefinnande 9-12 månader efter förlossningen. Totalt 410 kvinnor deltog i studierna. Resultatet visar att tidigare kända riskfaktorer såsom förlängt utdrivningsskede, barnets huvudomfång och födelsevikt, inte påverkade förekomsten av UI. Studie IV visade att för kvinnor med bristnings grad 1 och 2 kan tarmtömningssvårigheter, anal- och gas inkontinens 9-12 månader efter förlossningen vara jämförbara med de symtom som kvinnor som drabbats av analsfinkterskada upplever. Kvinnorna rapporterade att tarmtömningsbesvär, AI och UI påverkade deras vardagsaktiviteter, vilket hade samband med deras psykologiska välbefinnande.

Symtom ifrån bäckenbotten drabbar många kvinnor oavsett förlossningsskada. Det är viktigt att hälso- och sjukvården uppmärksammar dessa symtom oavsett grad av bristning och förlossningens förlopp.

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